A Modest Multiband Antenna

It's easy to put up an effective multiband antenna for casual HF operating.

By Al Brogdon, K3KMO
Managing Editor, *QST*

And so, after 23 years of enduring the oppressive heat and humidity of central Maryland's summers, I moved to Connecticut. Just in time for a winter that set a new record for total snowfall. Oh, well!

Time to start operation from a new location—time to put up an HF antenna. All I wanted was an antenna that would provide decent performance on all the HF bands—so I could check in with the 80-meter CW traffic nets, ragchew with old and new friends, do a little contesting, and occasionally chase DX. I soon realized that I could accomplish my goals with a simple wire antenna.

Let's walk through the process I followed in getting my antenna up and running, and use it to look at some of the considerations involved with getting a signal on the air with a simplistic antenna. Who knows, we might even take a few potshots at some sacred cows along the way.

The Design Process

Piece-of-wire antennas come in several variations. There is the G5RV; the Windom antenna; end-fed, center-fed, and off-center-fed dipoles, the double-extended Zepp, trap dipoles, the end-fed Marconi antenna, and so on. If you have a single wire of a given length at a given height above ground, all of these antennas provide about the same performance—there is no magic antenna or feed system. My personal preference, simply because it has worked well for me in the past, is a 135-foot dipole fed with ladder line. The only other component I'd need is an antenna tuner to transform the feed-line impedance to 52 Ω for my transceiver.

Why 135 feet? I want to operate down to the bottom end of the 80-meter CW subband. A half-wave dipole at 3.5 MHz is 133.7 feet. A little extra length ensures that it will tune to the bottom of the band, in the event other factors raise the antenna's resonant frequency.

How did I calculate the length? If you can remember one three-digit number, you can do a lot of practical antenna calculations with it. That number is *468*. Divide 468 by the operating frequency, in megahertz, and you get the length, in feet, of an HF half-wave dipole (thus, 468 ÷ 3.5 = 133.7).

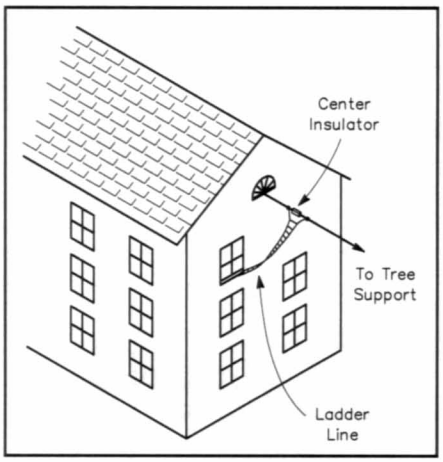

Figure 1—I positioned the center feedpoint of the antenna so that it was just above the window to my radio room. A straight drop of ladder line did the trick.

The lot for my three-family apartment building is small, so I couldn't put up a 135-foot antenna outdoors. I'm on the third floor and I have access to the fourth-floor attic, where the peak of the roof line is perhaps 40 feet above the ground. The length of the attic, front to back, is about 50 feet, not that far from half of the dipole's length. *All right!* I would put one half of the dipole in the attic and the other half out across the backyard. It's a wood-frame building, so the roof is almost transparent to RF in the HF range. Half the antenna in the attic is almost as good as all of it outdoors.

By browsing through the display ads in *QST*, I learned that I could buy a precut 135-foot dipole with 100 feet of ladder line already attached at a price not much greater than the cost of the ladder line, insulators, and wire. So I bought one, and saved myself the trouble of gathering up all the parts, measuring, cutting, soldering, etc.

Stringing It Out

For mechanical reasons, I wanted the feedpoint to be just outside the rear attic window. Then there would be a straight drop of ladder line down to the window of my shack (see Figure 1). I started the installation by tying off the center insulator of the dipole to a point just above the attic window. Then I dropped the "outdoor" half of the dipole from the attic window. I went to the backyard and walked the end of it over to a friendly tree on the rear fence line.

It's often convenient to use tree limbs to support wire antennas. If the limb I want to use is high above the ground, I use a Wrist Rocket slingshot (the kind with a stabilizing wrist bar on it) to shoot a 2-oz teardrop-shaped fishing weight over the limb with light nylon twine attached. If the antenna isn't heavy, the same twine can be used for support; for heavier antennas, the nylon twine can be used to

pull up a heavier rope for support. Polypropylene rope is a good choice for antenna supports: it's inexpensive and it weathers well. Both nylon twine and polypropylene rope are common hardware-store items.

This time, my target limb wasn't very high off the ground, so I tossed a 4-oz fishing weight over the limb by hand. After getting the twine over the tree limb, I hauled up the end of the dipole, with the end insulator coming into position about 20 feet above the ground. When using a tree as a support, I always tie the support off with a little slack in the antenna, to allow for the tree bending in the wind.

Cool! Halfway through the job, after only about 15 minutes' work!

Then I went back to the attic and walked the other half of the dipole along the length of the attic, threading it up and over the roof crossbraces, just under the peak of the roof line. When I reached the far end of the attic, there was still some wire remaining. Remember, the attic is about 50 feet long and half of the dipole is 67.5 feet long. At that point, I screwed a TV-cable insulator into a roof joist. I ran the antenna wire through the insulator, then went off at a 90° angle in the horizontal plane and at a downward angle of about 20°, following the slope of the roof. When I came to the end of the antenna, I pulled the wire taut and drove a small nail through the eye of the insulator into the roof joist (see Figure 2).

It's preferable to have all of a dipole in the same vertical plane, but, if necessary, the wire can wander around in other directions without much degradation of antenna performance.

Back to the attic window and the center insulator. I let out the ladder line gently, so it wouldn't get twisted or tangled. Then I went downstairs to the ham shack, where I used a broom to reach out and snag the ladder line to pull it in the window.

And now we address an important question: How long should the feed line be? My theory is that it should be long enough to reach from your rig to the antenna. A little longer is okay, but do not make it any shorter. If you're using an antenna tuner, you can match almost any feedline length. (You could be safe and cut the feedline about 5 to 10 feet longer than necessary, just in case you move the rig to another place in the room!)

Tuning and Loading

I use an MFJ-986 antenna tuner to match my feedline to my TS-50 transceiver. Such a large tuner is overkill, but I thought someday the dreaded high-power bug might bite me again, so I wanted to be ready. (There is no known inoculation against this bug, and sometimes hams have known to have been bitten and never recover. Fortunately, the effects are seldom fatal. And remember, it's helpful to always keep in mind the well-known saying, "Life's too short to argue about QRP versus QRO!")

I had already installed the best ground that was available—a short run of 1/2-inch-wide braid from the antenna tuner to a nearby cold-water pipe. When you're on the third floor, you will more likely have *grounding* problems than antenna problems!

The antenna loaded very easily on 80 meters. On most of the other bands it also loaded well. But on 40 meters it was obvious I had too much RF floating around the shack, and the poor little TS-50 (which says a cheery *HELLO* on its display when you first turn it on) would suffer from RF overload and say **HELLO** when I tried to tune up. To cure this problem, I laid out a single-wire 40-meter quarter-wave counterpoise—33 feet of small-gauge wire connected to the ground terminal of the tuner and run around the baseboard of the room the shack is in, through the doorway, and along the baseboard in the next room. This helped with the problem of RF in the shack on 40 meters, so that I can run 50 W if necessary. Because the antenna is partially indoors, however, I run the TS-50 at 10 W most of the time.

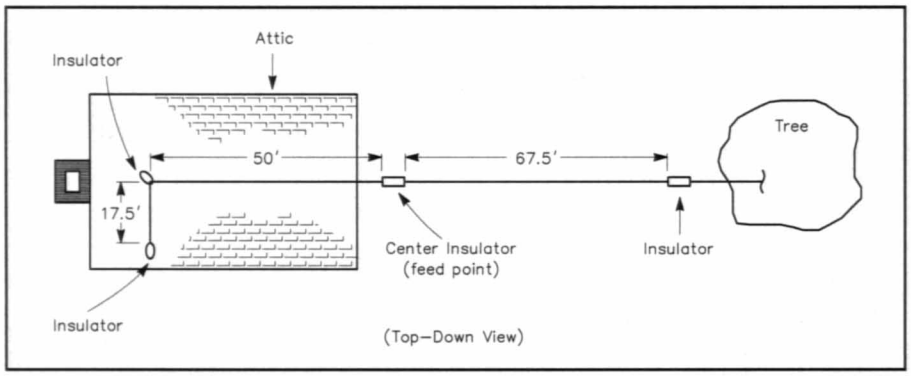

Figure 2—There is no rule that says a dipole antenna must be installed entirely outdoors—or even in a straight line! There wasn't enough room inside the attic, so I bent half of the antenna wire to fit the space.

If you have a loading problem on *any* band, or too much RF in the shack on a given band, try putting out a single-wire counterpoise cut to the frequency band where the problem exists, as I did. Sometimes the solution to a problem is elegant in its simplicity...if you're lucky!

The way I adjust the antenna tuner is simple. I continually monitor the reflected power on the wattmeter, with the range set to its lower scale, and tune for minimum reflected power. A lot of hams use their SWR bridges to continuously monitor their forward power, to convince themselves that RF is indeed going down the feed line. It makes more sense to be aware of how much RF is coming back at you. This information is often more important!

With wire HF antennas that are of varying height above the ground, it is important to be sure that, on each band, high-current portions of the antenna are well elevated. Check the antenna standing-wave current-distribution patterns as shown in the *ARRL Handbook* or the *ARRL Antenna Book* to visualize where the high-current portions of an antenna are on the different frequency bands. Then you can install your antenna to be sure that a high-current part of the antenna, on each band, is as high in the air as possible.

So How Does it Work?

I'm happy to report that my dipole works well on all the HF bands, and I have no trouble making solid contacts. The antenna works surprisingly well even on 160 meters. I've worked California and Washington, DS (De State—as opposed to Washington, De Capital), and several Caribbean DX stations on 160, but I must admit that more credit goes to the tenacity of 160-meter operators than to the loudness of my signal.

Now that summer has, at last, come to New England, I'm starting to think about antennas to build inside that large, empty attic. A 40-meter horizontal loop would just fit, and I have some ladder line left over from my dipole project that I could use to feed it. Kirk Kleinschmidt, NTØZ, described a cheap and easy fixed-azimuth wire-element triband beam for his attic in the *ARRL Antenna Compendium*, Vol. 2, pp 61-63. It may be hot in the attic right now, but what's a little heat to an enthusiastic ham? QST